RESEARCH TRAINING GROUP
Models of Gravity

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Nonlocal Star as a Blackhole Mimicker

Abstract

In the context of ghost-free, infinite derivative gravity, I will provide a quantum mechanical framework in which we can describe astrophysical objects devoid of curvature singularity and event horizon. In order to avoid ghosts and singularity, the gravitational interaction has to be nonlocal. Quantum mechanically a nonlocal star is a self-gravitational bound system of many gravitons interacting nonlocally. Outside the nonlocal star the spacetime is well described by the Schwarzschild metric, while inside we have a non-vacuum spacetime metric which tends to be conformally flat at the origin. In the most compact scenario, the radius of a nonlocal star is slightly larger than the conventional Schwarzschild radius and saturates the Buchdahl's bound. These objects live longer than the Schwarzschild black hole and they are very good absorbers, due to the fact that the number of available states is larger than that of a black hole. As a result nonlocal stars, not only can be excellent black hole mimickers, but can also be considered as a dark matter candidate. In particular, nonlocal stars with masses below 1014g can be made stable compared to the age of the Universe.